TECHNICAL BACKGROUND DOCUMENT FOR THE REPORT TO CONGRESS ON REMAINING WASTES FROM FOSSIL FUEL COMBUSTION:

POTENTIAL DAMAGE CASES

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1.0 INTRODUCTION

In its evaluation of remaining fossil fuel combustion (FFC) wastes, EPA evaluated damage cases in the same way as in previous reports to Congress for Resource Conservation and Recovery Act (RCRA) §8002 wastes (i.e., the 1993 Report to Congress on Cement Kiln Dust and the 1990 Report to Congress on Special Wastes from Mineral Processing). Specifically, EPA used a "test of proof" in these reports to identify documented damage cases. For the current Report to Congress, EPA evaluated a number of cases but found that only some of them met EPA's "test of proof." The purpose of this technical background report is to present EPA's analysis of all the cases evaluated and present EPA's reasoning for including or not including the sites in the Report to Congress.

Section 8002(o)(4) of RCRA requires that EPA's study of remaining FFC wastes examine "documented cases in which danger to human health or the environment has been proved." To address this requirement, EPA defined danger to human health or the environment in the following manner. First, danger to human health includes both acute and chronic effects (e.g., directly observed health effects such as elevated blood lead levels). Second, danger to the environment includes the following types of impacts: (1) significant impairment of natural resources (e.g., contamination of any current or potential source of drinking water with contaminant concentrations exceeding drinking water and/or aquatic ecological standards); (2) ecological effects resulting in degradation of the structure or function of natural ecosystems and habitats; and (3) effects on wildlife resulting in damage to terrestrial or aquatic fauna (e.g., reduction in species' diversity or density, or interference with reproduction).

As stipulated in RCRA §8002(o)(4), EPA is statutorily required to examine proven cases of danger to human health or the environment. Accordingly, EPA developed "tests of proof" for the above-mentioned reports to Congress to determine if documentation available on a case provides evidence that danger or damage has occurred. EPA uses the same methodology here. These "tests of proof" consist of three separate tests; a case that satisfies one or more of these tests is considered "proven." The tests are as follows:

- **Scientific investigation.** Damages are found to exist as part of the findings of a scientific study. Such studies should include both formal investigations supporting litigation or a state enforcement action, and the results of technical tests (such as monitoring of wells). Scientific studies must demonstrate that damages are significant in terms of impacts on human health or the environment. For example, information on contamination of a drinking water aquifer must indicate that contaminant levels exceed drinking water standards.

- **Administrative ruling.** Damages are found to exist through a formal administrative ruling, such as the conclusions of a site report by a field inspector, or through existence of an enforcement action that cited specific health or environmental damages.

- **Court decision.** Damages are found to exist through the ruling of a court or through an out-of-court settlement.

As a practical matter, EPA employed a fourth criterion in determining whether damages were proven: available information needed to clearly implicate *FFC wastes* in the damages observed. EPA explored many cases with complicated site histories and complex mixtures of wastes. At some sites, damages were clearly demonstrated, but those damages were caused by wastes other than FFC wastes or involved contaminants not associated with FFC wastes.

2.0 SITES EVALUATED FOR DAMAGE CASES FROM COMANAGED COAL COMBUSTION WASTES

EPA's research of damage cases associated with wastes from FFC dates back to research conducted for the 1988 Report to Congress. In that report, and in the subsequent 1993 Regulatory Determination (48 FR 42473, 8/9/93), EPA principally identified damage cases associated with the management of coal ash, and identified a smaller number of damage cases associated with comanagement. More recently, EPA has identified further potential damage cases associated with comanaged wastes through industry and EPA data that previously were not available.

This section identifies cases in which detrimental environmental effects have been observed at FFC waste comanagement sites. In most cases, these effects do not meet the "test of proof" for a damage case as detailed by EPA in the 1993 Cement Kiln Dust Report to Congress or 1993 Regulatory Determination for FFC wastes. Additionally, it is usually difficult to determine if the detrimental effects are due chiefly to comanagement or to large-volume wastes alone. In other cases it is likely that comanagement contributed additional detrimental effects.

2.1 RESOURCES USED TO COMPILE DAMAGE CASES

Chapters 5.2 and 5.3 of the 1988 Report to Congress reported evidence of contaminant releases and evidence of damages (respectively) from coal combustion waste (CCW) management. Six studies representing more than 110 disposal sites documented effects from large-volume wastes managed alone and from comanaged wastes. The 1993 Regulatory Determination found that only two of the six cases met EPA's "test of proof" for damage cases. For most sites, insufficient information was available to identify whether comanagement was present (this was particularly true for two studies representing 90 sites). More recent review of the information presented in the report showed that four of these sites clearly represent comanaged waste disposal.

Additional information on damage cases was compiled for the 1993 Regulatory Determination. Specifically, four of the cases met EPA's "test of proof" as described in the 1993 Regulatory Determination. EPA reviewed the Supplemental Analysis to the Regulatory Determination and found a total of five sites where comanagement exhibited damages or releases. Although only four of the five sites met EPA's "test of proof," all represent releases from waste management units.

Finally, EPA investigated the CERCLA information system (CERCLIS) to identify sites. EPA used a keyword search followed up by reviews of site summaries and other data.

2.2 OVERVIEW OF THE 1988 REPORT TO CONGRESS AND 1993 REGULATORY DETERMINATION IN REGARD TO DAMAGES FROM COMANAGED WASTES

EPA identified two sites discussed in the 1988 Report to Congress and four additional sites identified in preparation of the 1993 Regulatory Determination that meet the "test of proof" criterion for damage cases. Further, EPA determined that all but two of these damage cases were associated with comanagement.[1] These findings were presented in the 1993 Regulatory Determination. With the exception of the Faulkner site, EPA did not conduct further research or investigation of these sites beyond what was presented in the record for the 1993 Regulatory Determination. The five sites are discussed briefly below:

- **Chisman Creek, VA (described in the 1988 Report to Congress).** Fly ash and bottom ash from the burning of coal and petroleum coke were managed in a disposal pit. The site was on the National Priority List as of 1988. Drinking water wells became green from vanadium and selenium contamination, containing selenium above the primary maximum contaminant level (MCL) and sulfate above the secondary MCL.

- **Possum Point, VA (described in the 1993 Supplemental Analysis).** At this site, oil ash, pyrites, boiler chemical cleaning wastes, coal fly ash, and coal bottom ash were comanaged in an unlined pond, with solids dredged to a second pond. Levels of cadmium above 0.01 mg/L were recorded prior to 1986 (the primary MCL is 0.005 mg/L). After that time, remedial actions were undertaken to segregate wastes (oil ash and low-volume wastes were believed to be the source of contamination). Following this action, cadmium concentrations were below 0.01 mg/L.

- **Faulkner, MD (initially described in the 1993 Supplemental Analysis).** Pyrites, fly ash, and bottom ash were comanaged in unlined landfills. In 1991, the state of Maryland found that water quality in a nearby stream and creek were degraded by landfill leachate, with effects including orange staining from iron precipitation and low pH (3 to 4). An underlying aquifer was found to be affected by the landfill leachate. The acidic leachate was believed to have resulted from pyrite oxidation. Remedial measures at the site included closure and capping of older units, installation of liners in newer units, and discontinuing mill reject comanagement at the facility.

- **Old E.J. Stoneman Ash Pond, WI (described in the 1993 Supplemental Analysis).** Ash, demineralizer regenerant, and sand filter backwash were managed in an unlined pond from the

[1] Available information on the 1988 Report to Congress case for Clinch River and the 1993 Regulatory Determination case for Cedar Sauk landfill does not demonstrate that comanagement was practiced at either site.

1950s to 1987. Nearby private drinking water wells had elevated levels of sulfate and boron relative to background; monitoring wells installed around the pond showed exceedences of the primary MCL for cadmium and chromium, but these constituents were not detected in the drinking water wells. As a result of the presence of indicator parameters in the drinking water wells, the state concluded that other parameters may reach the wells in the future and, therefore, required the operator to close the site and provide alternative drinking water to the affected residences.

2.3 SITES IDENTIFIED IN CERCLIS

To identify additional damage cases, EPA surveyed the CERCLIS database for sites contaminated with coal ash. Using the methodology outlined below, EPA identified one site where FFC wastes likely contributed to negative environmental effects or damages. At this site, coal combustion ash, ash from the burning of non-fossil fuels, and other wastes from coal combustion were disposed in a surface impoundment. Ground-water and surface water contamination was observed and remedial action of capping was conducted to minimize further environmental effects. Constituents of concern included heavy metals, such as arsenic, chromium, and zinc.

Using a keyword search and an initial verification of the data, EPA identified more than 30 candidate sites for further review. Most of these sites contained materials unrelated to FFC (e.g., MSW incinerator ash). EPA determined that CCWs were present at the following eight sites:

- A surface impoundment in Velva, North Dakota
- A landfill in Rome, Georgia
- A landfill in Lowville, Pennsylvania
- An unauthorized dump in Harrison, Wisconsin
- Five ash drying beds in Janesville, Wisconsin
- A settling basin in Pryor, Oklahoma
- A manufacturing facility in Trenton, New Jersey
- A high school football field built on a fly ash dump in Niagara Falls, New York.

For each of these cases, final determinations on the potential contribution of coal ash to contamination were based on reports and testing, as well as on conversations with EPA personnel familiar with each case. In seven of these cases, the available information suggested that either FFC wastes were not present at the site, or that these wastes were not implicated in actual damages. FFC wastes were implicated in actual damages at one site—the Basin Electric Surface Impoundment (BESI) at WJ Neal Station in Velva, North Dakota.

The BESI is an unlined, diked impoundment that received various construction debris and ash from the burning of sunflower seed hulls, as well as fly ash and sludge from a nearby coal-fired power plant from the 1950s until the late 1980s. Monitoring efforts and negotiations for plant closure began in 1982 after chromium was found at 8.15 parts per million (ppm) in the sludge pond, in excess of the standard criteria for chromium. In 1990, chromium readings were as high as 146 ppm within the ash pile and 390 ppm in a downgradient sediment sample. A Preliminary Assessment in 1989 indicated migration of contaminants into the underlying aquifer that supplies the city of Velva with drinking water, although sampling data were not provided. Downgradient ground-water contamination from the unlined impoundment was documented in 1991, with maximum concentrations of aluminum, arsenic, barium, copper, and zinc from three downgradient wells at least three times the levels found in one upgradient well. In 1995, ground-water samples from one well in Velva revealed concentrations of cadmium, copper, lead, and zinc at levels three times the levels in one background well, although of these metals, only zinc has been documented as a source contaminant at the BESI site. Release of contaminants from the site to surface water is likely because runoff from the impoundment drains offsite directly into surface water. In 1991, maximum concentrations of chromium, arsenic, and other contaminants from one downgradient surface water and two downgradient sediment samples were found at levels several times the levels found in one upgradient site. Testing in 1995 showed similar results, with arsenic, iron, and magnesium levels in one downgradient wetlands area at more than three times the levels in one upstream sample.

A site inspection report and power cooperative records from BESI confirmed that fly ash and sludge from the BESI coal-fired power plant were deposited in the impoundment. Monitoring data indicate the presence of contaminants found in the wetlands adjacent to the site, as well as in samples taken of surface water and ground water. Areas of soil contamination within the impoundment were consolidated and the impoundment was capped when the site was closed in 1990. EPA has concluded the contamination was a result of activity that occurred before the cap was in place.

2.4 SITES IDENTIFIED BY EPRI

The Electric Power Research Institute (EPRI) has conducted and published studies regarding the management of coal mill rejects with CCWs, and the comanagement of CCWs in general. Most recently, case studies specific to mill reject management at five plants have been summarized in *Characteristics and Management of Mill Rejects at Electric Power Plants*, 1998 (draft). As documented in this report, mill rejects contain pyritic sulfur at levels ranging from less than 0.01 percent to more than 20 percent,

depending on the source of the coal. This report summarizes mill reject management methods and associated ground-water quality at five facilities: HA, HN, L, BR, and MO. EPA reviewed this report as well as the more detailed facility-specific reports associated with these facilities, with the exception of the HN site.[2] EPA also reviewed the EPRI report, *Results of a Coal Pile and Mill Rejects Investigation at a Power Generating Station*, 1997, documenting environmental quality at another site. This latter report discussed environmental monitoring and quality from the management of mill rejects, mill reject leachate ponds, and coal pile runoff. Because the report discusses the management of low-volume wastes only, it was not further considered in the assessment of damage cases.

EPA's review of this information showed only one site potentially meeting the "test of proof" for damage—the MO site. On further review, however, EPA determined that insufficient evidence existed. At this site, various low-volume wastes, including mill rejects, are comanaged with fly ash and bottom ash in a surface impoundment. Following the identification of seepage to a ditch, the facility constructed a slurry wall around the impoundment; EPA found no technical or administrative demonstration of damage. The MO site operator applied for permit renewal of surface impoundment operation under Pennsylvania's residual waste regulations. The permit was initially denied due to insufficient characterization of hydrology and contaminant sources. The permit was later granted following state review of improved monitoring, a finding of limited impacts to ground water, and a repair of a leak in the slurry wall. EPA found no documentation of administrative orders or similar findings that show damage to human health or the environment (Pennsylvania Department of Environmental Protection, 1998; EPRI, 1997).

[2] EPA lacked sufficient information to evaluate the HN site as a damage case.

3.0 SITES EVALUATED FOR DAMAGE CASES FROM NON-UTILITY FOSSIL FUEL COMBUSTION WASTES

3.1 INTRODUCTION AND SUMMARY OF FINDINGS

EPA has observed a low frequency of documented damages to human health and the environment from non-utility FFC wastes. EPA used two sources of information to identify potential damages from these wastes: (1) collection of data from six states by visiting state offices and searching records, and (2) searching Records of Decision at sites where FFC wastes were disposed. EPA's review of sites on the National Priority List revealed no sites where non-utility FFC wastes were disposed; this search did, however, reveal a site comanaging utility FFC wastes. EPA also became aware of an additional site through a press release in a national journal.

Effects observed from sites managing non-utility FFC waste sites have included ground-water contamination, uncontrolled release of leachate, and emission of odors. Ground-water contamination has typically resulted from sites where FFC wastes have been codisposed with other wastes, where the cause of the contamination is not identified (e.g., the presence of sulfate near a landfill used for the codisposal of coal ash and pulp mill wastes), or is clearly attributable to non-FFC wastes (such as the presence of uranium at a site used for uranium processing). In other cases of possible ground-water contamination, where FFC wastes are exclusively, or almost exclusively, managed at the site, limited documentation does not satisfy the "tests of proof."

3.2 REVIEW OF STATE FILES

EPA collected information on the generation and management of combustion residues at non-utilities from six states (Illinois, New York, North Carolina, Pennsylvania, Virginia, and Wisconsin). EPA identified facilities within these states that were likely to generate FFW wastes and operate nonhazardous industrial landfills. Facility-specific information was collected from conversations with state personnel and the review of facility-specific files at state offices. Detailed information was collected for about 50 sites. A more complete discussion of the data is presented in *Fossil Fuel Combustion: Risk Comparison between the Utility and Non-Utility Industries* (EPA, 1997). This information was used to identify potential environmental effects, as well as to collect information regarding how non-utility combustors manage their wastes.

In all cases, available information was too incomplete to fully evaluate releases or environmental effects. In addition to differing requirements among states, facilities within an individual state have differing requirements depending on age, industry, and so on. When ground-water monitoring data were available for review, upgradient and downgradient wells were not always clearly distinguished and not all parameters present in FFC wastes were required for monitoring. Nevertheless, the lack of documented citizen complaints or negative impacts to the surrounding environment, in conjunction with the reviewed monitoring data, show a low frequency of documented damages to human health and the environment from non-utility FFC wastes. Specific findings for these 50 sites include the following:

- The Fort Howard (WI) site was proposed for inclusion on the National Priority List in 1988 but was denied. Paper mill sludge and boiler ash (generated from the coburning of coal and petroleum coke) is codisposed at this site. In 1982 the facility installed a leachate collection system in response to state requirements and resident complaints about odors. In 1990, a Consent Order was signed by relevant parties (including the state) to conduct a Remedial Investigation. Although ground-water monitoring revealed the presence of inorganic and organic contaminants in onsite monitoring wells, in 1994 the state determined that no further action was required. Contaminants observed at the site are commonly associated with paper mill sludge and cannot be clearly attributed to FFC wastes. Therefore, the site was excluded from further consideration.

- The Cranston Print Works (NC) site is on the inactive hazardous waste sites priority list, although the reasons for inclusion on the list (including hazards to human health or the environment) are not clear in the information reviewed. Specific permit violations and complaints include the following: severe odors from the fly ash pond, and National Pollutant Discharge Elimination System (NPDES) permit violations of total suspended solids and fecal coliform. Coal combustion fly ash is managed at this site. Odors and fecal coliform are contaminants not associated with FFC wastes, so the site was excluded from further consideration.

- Georgia Pacific (VA) operated a landfill from 1981 to late 1980s. A 1995 Compliance Inspection showed a “failure to comply” in regard to erosion protection, evidence of soil erosion, and leachate discharge to surface water. Human health or environmental impacts, if any, were not documented from this violation. Therefore, no “test of proof” was met and the case was dropped from further consideration.

- At the Ecusta (NC) ash monofill, heavy rains in 1989 led to the displacement of 50,000 cubic yards of ash. The spill did not extend offsite, and no damages to human health or the environment were documented. Therefore, no “test of proof” was met and the case was dropped from further consideration.

- The Flambeau (WI) site is a landfill for the codisposal of ash and paper mill wastewater treatment sludge. A 1992 Hydrogeologic Investigation indicates the site has been severely

contaminated by past use as a sulfate liquor storage area. In 1987, facility staff violated their landfill disposal permit by storing wastewater in a cell; no damage to human health or the environment is documented. Because the contamination at this site is strongly associated with non-FFC wastes, the case was dropped from further consideration.

- Ground-water contamination was found at four sites (all landfills) where FFC wastes are principally or solely managed. Principal contaminants include lead and selenium, each found at one of the four sites above state levels or found to have increased in concentration. Other parameters found above state levels or found to have increased include alkalinity, boron, biological oxygen demand (BOD5), total dissolved solids (TDS) (2 sites), iron (3 sites), conductivity (2 sites), sulfates (4 sites), potassium, hardness, chemical oxygen demand (COD) (2 sites), chloride, and pH (2 sites). These four sites are Ecusta (NC), BASF (NC), Appleton (WI), and Niagara (WI). In general, no conclusions or actions by the state were documented with these data, and in some cases the elevated concentrations are not necessarily damages, due to the presence of high background levels. None of these cases satisfied a "test of proof," so each was dropped from further consideration.

- Ground-water contamination was found at 15 sites (all landfills) where FFC wastes are codisposed with other wastes, including paper mill wastes or organic chemical manufacturing wastes. Principal contaminants include arsenic, barium, cadmium, chromium (3 sites), lead (2 sites), mercury, and zinc at elevated levels or above state limits, found at 5 of the 15 sites. Other parameters found above state levels or at elevated levels include calcium (3 sites), sodium (4 sites), sulfate (8 sites), TDS (2 sites), color, chloride (8 sites), iron (10 sites), COD (4 sites), specific conductance (7 sites), total organic carbon (TOC) (2 sites), alkalinity (4 sites), hardness (3 sites), phenol, manganese (2 sites), and magnesium. As above, no conclusions or actions by the state were documented with these data. Because none of these cases satisfied a test of proof, each was dropped from further consideration.

- At the remaining 26 sites (about half of those investigated), either insufficient information was available or no negative impacts were recorded.

Based on this review, EPA concluded that none of the sites met the "test of proof" for damage. Although releases of waste has been documented and ground-water monitoring results show exceedence of standards in some cases, there is a lack of documented conclusions and follow-up actions by the state regarding the cause of contamination or evidence of damage.

3.3 RECORDS OF DECISION AND OTHER SOURCES

EPA examined Superfund sites to identify the presence of FFC wastes and to determine the impact, if any, on the environmental damages and releases observed at the sites. EPA also became aware of an additional damage case through a press release reported in the *Environmental Reporter*.

In its investigation of Superfund sites, EPA identified candidate sites using a keyword search in the Record of Decision System (RODS), and subsequently reviewed fact sheets and Records of Decision to obtain more detailed information about the presence of FFC wastes at the site. Each of these sites is a Superfund site where detailed investigation and decisions concerning remedial actions have been made. EPA found four such sites where FFC wastes were disposed and appear to comprise a significant portion of the wastes disposed. At a fifth site (Hooker 102nd Street Landfill, NY) fly ash comprised much less than 1 percent of the total waste volume and, therefore, conclusions between associated site damages and FFC wastes would be impossible.

In two cases the ash resulted from industrial (non-utility) coal combustion ash disposal; in the other two cases the source of the ash was not provided. Evaluation of the sites was complicated by the following factors: (1) disposal ceased at least 10 years ago, (2) non-FFC wastes are comanaged with FFC wastes at all the sites, and (3) greater detail regarding the FFC wastes was not available in the reviewed documents (more detailed information may be available in Remedial Investigation reports, which were not reviewed). EPA concluded that none of the cases satisfied a "test of proof" and each was dropped from further consideration.

As detailed in the site summaries presented below, EPA has made the following conclusions regarding FFC wastes from non-utility sites:

- Runoff and wind erosion from coal ash piles is a demonstrated release pathway (the Feed Materials site). A pile used for disposal of fly ash and bottom ash required mitigation of wind and water erosion in 1992.

- Ground-water migration of inorganic constituents has been observed at most sites. The source of contaminant was not definitively identified in the documents. These inorganic constituents include antimony (Salem Acres site), arsenic (Wheeler Pit and Salem Acres sites), barium (Lemberger Landfill site), cadmium (Lemberger Landfill site), chromium (Wheeler Pit and Lemberger Landfill site), and manganese (Wheeler Pit and Salem Acres sites).

- At one site where low-volume FFC wastes (boiler plant blowdown and coal pile runoff) were disposed in an impoundment in the absence of comanagement, no damages were associated with the practice (Feed Materials site).

The Wheeler Pit (Janesville, WI) was originally a sand and gravel pit subsequently used for the disposal of GMC's Janesville auto assembly plant wastes between 1960 and 1974. Wastes reportedly disposed

included paint-spray booth sludge, wastewater treatment sludges, and coal ash from the plant's boilers; approximately 60,000 cubic yards of waste is present. Arsenic and chromium were present in downgradient monitoring wells below MCLs but above state action limits; manganese was present above its MCL. Several volatile organic compounds also were detected in ground water below MCLs. The ROD concluded that no principal threat warranting treatment has been identified. Sources of these contaminants (i.e., from sludges or from ash) were not identified; therefore, the case did not conclusively link FFC wastes to observed damages.

The Salem Acres (Salem, MA) National Priority List site is composed of unlined sludge lagoons containing tannery wastes (typical components include chromium and greases), contaminated soil areas, a landfill, a debris pile, and a fly ash pile. Wastes were disposed at the site from the mid 1940s to 1969; the source of the ash (utility or non-utility) was not provided in the source documents. The volume of fly ash is estimated to be 9,600 cubic yards; the volume of lagoon sludge is estimated to be 21,000 cubic yards. Therefore, the ash comprises a significant percentage of the overall waste volume present. Ground-water monitoring showed arsenic to be present below its MCL. The ROD concluded that several areas of the site, including the fly ash pile, pose health risks exceeding risk management criteria. Ground-water risks from antimony and manganese also were identified. Based on review of the ROD, EPA concluded that while risks associated with fly ash were identified, damages could not be linked to fly ash to the exclusion of other wastes present.

An old gravel pit, the Lemberger Landfill (Whitelaw, WI), was used for waste disposal from 1940 to about 1980. Wastes disposed included general refuge, power plant fly ash (1969 to 1977) and bottom ash (1969 to 1976), and municipal solid waste. Other industrial wastes also were disposed at a nearby site. Environmental effects and damages included the seepage of landfill leachate onto adjacent property, presence of volatile organic compounds in drinking water wells, the presence of organic compounds in surface water, and potential effects from direct soil or waste contact. Inorganic constituents detected in the ground water include barium, cadmium, and chromium. The source of contamination was identified as the landfilled waste, although specific wastes were not identified in the ROD as contributing or not contributing to the ground-water contamination. Based on review of the ROD, EPA concluded that the site does not clearly implicate FFC wastes in the observed damages.

The U.S. Department of Energy operated the Feed Materials Production Center (Fernald, Ohio) from 1952 to 1989. Uranium production wastes and fly ash wastes are disposed in the area. Specific FFC wastes

included (1) coal pile runoff and boiler plant blowdown waters managed in lime sludge ponds, with other non-FFC wastes; (2) disposal of fly and bottom ash in several piles and burial sites with non-FFC wastes; and (3) disposal of fly and bottom ash in an active pile with no other wastes. The ROD concluded that no impact from the Lime Sludge Ponds has been observed on the underlying aquifer, and that radionuclides (in the aquifer) appear to be connected to non-fly ash waste.

EPA initially became aware of another damage case involving FFC waste through a press release reported in the *Environmental Reporter* and obtained additional information from the West Virginia State prosecutor's office. In this case, IMC Corporation pleaded guilty to discharging a hazardous waste with pH > 12.5 (caustic chemical which had been mixed with water and heated in a boiler for several hours) from its manufacturing facility in Sutton, West Virginia, into a ditch. At least one child who came into contact with the material by walking through the ditch received burns and was taken to the hospital. EPA notes that this damage case involves FFC low-volume waste only, which is not within the scope of the existing Bevill exemption.

4.0 SITES EVALUATED FOR DAMAGE CASES FROM FLUIDIZED BED COMBUSTION WASTES

EPA relied on a report prepared by the Council of Industrial Boiler Owners (CIBO) to assess releases and damage cases to human health or the environment involving Fluidized Bed Combustion (FBC) wastes (CIBO, 1997). Although EPA is not aware of additional incidents, EPA has not specifically pursued other references to further identify other FBC waste management sites that document releases or damages. The CIBO report identified eight sites managing FBC wastes where ground-water or surface water contamination was observed. EPA concluded from the review of these cases that contamination likely resulted from other sources and, therefore, the observed damages do not result from FBC waste management.

The resources used by CIBO in identifying damage cases included court case review, a report by the Pennsylvania Bureau of Mining and Reclamation, and results from an industry survey conducted by CIBO. Management methods at these sites included landfilling and surface mine reclamation, which is reflective of the predominant management methods of FBC wastes.

In reviewing these results, EPA attempted to determine (1) if damages or releases occurred at sites where FBC wastes are (or were) managed, and (2) the degree to which FBC wastes could be the cause of such damages or releases. The CIBO report presents “case studies” of eight sites where damages or releases occurred (the number of sites actually reviewed is much larger).

Primary or secondary MCLs were exceeded in ground water or surface water at these eight sites. The management methods included one Subtitle D surface impoundment, five mining sites, and two landfill sites. At the mining sites, FBC wastes are added to areas where acid mine drainage has historically been present. Placement of FBC wastes at these sites began relatively recently. Some sites have historical ground-water monitoring data demonstrating elevated levels of contaminants in downgradient ground water prior to the addition of FBC wastes, while other sites offer more qualitative information. Therefore, although contamination is present, pre-placement activities and/or other sources may be the cause.

At the impoundment site and one of the landfill sites, nitrate, sulfate, and other unspecified contaminants exceeded primary or secondary MCLs in downgradient wells; however, these contaminants also were found in upgradient wells at similar concentrations. Therefore, at these two sites FBC wastes do not appear be

the source of contamination. At the final landfill site, lead was identified as present in downgradient wells above its MCL. Little additional information was provided (e.g., upgradient results, other land use); however, because the management unit has synthetic liners with a leachate collection system, and lead concentrations in FBC wastes rarely exceed 70 mg/kg (Section 6.1 of this Report), FBC wastes are unlikely to be the cause of this exceedence.

While analysis of the FBC wastes found ground-water and surface water contamination at eight sites, the contamination cannot clearly be attributed to FBC wastes. In seven of the cases, the contamination appears to be related to pre-existing conditions, while at the eighth site insufficient historical information is available and the contaminant found in the ground water is inconsistent with those typically present in FBC wastes.

5.0 SITES EVALUATED FOR DAMAGE CASES FROM OIL COMBUSTION WASTES

5.1 INTRODUCTION AND SUMMARY OF FINDINGS

EPA reviewed three sources to identify a total of nine sites managing oil combustion wastes (OCWs) that have ground-water contamination. Seven of the nine sites were documented in EPRI's oil ash report; the two other sites were found in the 1993 Regulatory Determination and from RCRA Corrective Action records. Most of the nine sites evaluated were solid settling basins, while one site had a landfill and a second site had a solids disposal pond. At each of the nine sites, the waste management unit was found to negatively impact ground water in one of the following ways: (1) at least one constituent was found in downgradient ground-water monitoring wells above its MCL, but was not present in upgradient wells above its MCL, or (2) a constituent exceeded its MCL both upgradient and downgradient, but the downgradient concentrations were noticeably higher than the upgradient concentrations. These constituents most often include manganese and nickel. Other parameters (including arsenic, cadmium, chromium, selenium, silver, and zinc) exceeded their MCL in downgradient wells at only one of the sites. Although vanadium does not have an MCL, the parameter was found in ground-water downgradient of waste management units.

At several of the sites reviewed, EPA found that the waste management unit very likely contributes to the contamination of constituents, such as manganese, nickel, and vanadium, into ground water. Many of these sites are located next to the ocean or other large bodies of water where such releases can be diluted and no drinking water wells would be located between the management unit and the surface water. EPA did not find any cases of drinking water contamination or other environmental damages resulting from these releases. Additionally, most or all unlined units are operated under state permit allowing exceedences of ground-water standards close to the management unit, but which must be met outside the zone of discharge. The EPRI report, however, generally did not discuss the presence or absence of environmental damages or discuss resulting actions by state agencies (if any).

At two sites studied by EPA (Fort Meyers, FL, and Possum Point, VA), the state required removal of oil ash waste from the management units. At the Possum Point facility, exceedences of constituents above primary MCLs were observed, while at the Fort Meyers facility, no exceedences of MCLs were determined. Therefore, only the Possum Point facility meets EPA's "test of proof" for identifying cases of damage.

5.2 RESOURCES USED TO COMPILE DAMAGE CASES

EPA did not identify any damage cases relevant to OCWs in the 1988 Report to Congress. EPA identified one damage case relevant to OCWs in the 1993 Regulatory Determination: a disposal site comanaging coal fly ash, coal bottom ash, pyrite and boiler chemical cleaning wastes, and oil ash (the Virginia Power Possum Point facility).

EPA reviewed the recent EPRI report concerning oil combustion byproduct management (EPRI, 1998). The report presented case studies of seven sites managing OCWs, some of which are discussed below. Finally, EPA learned of two damage cases at utility sites in Florida. At one of the sites, an RCRA corrective action is under way, but is unrelated to FFC waste management and is not discussed here. EPA collected information concerning a second site, Florida Power and Light's facility in Fort Meyers, Florida, from Region 4. A description of the damages associated with this site is presented later in this section.

In evaluating ground-water monitoring data relating to OCW management units, it is important to note that vanadium has no MCL; vanadium has been shown to have toxic effects and to be present in OCWs in significant concentrations. As a result, vanadium analysis is not always required for permit compliance, and, therefore, vanadium results are reported in the referenced materials less often than other constituents with primary MCLs, such as nickel.

5.3 FINDINGS FROM THE EPRI OIL ASH REPORT

An EPRI-sponsored study of oil combustion by-products (EPRI, 1998) reviewed ground-water conditions at seven plants. Five of the sites monitor ground water from unlined solids settling basins (SSBs) (or basins that were unlined for most of the time that ground-water monitoring took place), one of the sites was a lined SSB, and the seventh facility had monitoring data for both an unlined SSB and a lined landfill.

OCWs (including fly ash and associated plant wastewaters) were almost exclusively managed at the sites studied by EPRI. The EPRI results showed that several constituents of concern are present in ground-water downgradient of the management unit, and that levels in downgradient wells are noticeably higher than levels in upgradient wells at some of the sites. These constituents most often include manganese, nickel, and vanadium. The report, therefore, documents the apparent release of contaminants from OCW management into ground water, resulting in damage to a natural resource. The report does not present,

however, any information suggesting that ground water (or any resource) is impacted beyond the relatively small perimeter of the management site.

5.4 OTHER CASES OF RELEASE OR DAMAGE

One additional documented damage case is the Virginia Electric and Power Company (VEPCO) Possum Point Site, described in the 1993 Regulatory Determination. This is an active facility with 40-acre unlined ash ponds with solids dredged to 80-acre lined ponds. These ponds received coal ash, pyrites, water treatment wastes, boiler cleaning wastes, and oil ash. Ground-water monitoring found cadmium at concentrations 3.6 times and nickel 26.4 times the primary MCLs. Monitoring for vanadium was conducted but no results were given. The elevated concentrations were attributed to the pyrites and oil ash. These wastes, along with metal cleaning wastes, were ordered sequestered to separate lined units.

EPA also became aware of a site in Florida under RCRA corrective action. EPA obtained additional information concerning this site from Region 4 sources. EPA Region 4 identified the Florida Power and Light Fort Meyers (FL) plant during the RCRA Corrective Action as having historic oil basins. These unlined basins were in operation for 18 years prior to being backfilled in 1976, at which point they contained approximately 6,000 tons of oil combustion by-product. In 1995, Florida Power and Light evacuated the basins and disposed of the ash material and overburden in a class 1 landfill. Subsequent testing below the basin found nickel at levels below MCLs for drinking water. Likewise, surface water samples tested below detectable levels and sediment samples below Florida Department of Environmental Protection Sediment Quality Assessment Criteria for nickel. Region 4 has directed Florida Power and Light to perform an ecological risk assessment; the results of this assessment are not yet available.

6.0 REFERENCES

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